(12) UK Patent Application (19) GB (11) 2 067 135 A

(21) Application No 8100846
(22) Date of filing 12 Jan 1981
(30) Priority data
(31) 19158
(32) 11 Jan 1980
(33) Italy (IT)
(43) Application published 22 Jul 1981
(51) INT CL³ B32B 5/02 // 5/18 5/24 27/02 27/12 27/32
(52) Domestic classification B5N 0502 0518 0524 2702 2712 2732
(56) Documents cited
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GB 903986
GB 747474
(58) Field of search B5N

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(54) Improvements in or relating to panels of plastics material

(57) A rigid polyolefine plate of 0.5–4 mm thickness is bonded directly (i.e. without the interposition of an adhesive) on one or both faces to a relatively flexible layer of polyolefinic material, suitably by the plate surface being tacky as a result of the application of heat.

The applied layer may be e.g. polyolefine foam or a woven or non-woven polyolefine fabric. One important application of the panels, which may be made by concurrent bonding and thermoforming, is as automobile body linings.

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SPECIFICATION

Improvements in and relating to panels of plastics material

The present invention concerns structures based on rigid polyolefine plates lined with relatively flexible polyolefine layers and the process for obtaining such composite structures.

More particularly, the present invention relates to the preparation of rigid (i.e. self-supporting) composite structures suitable for use in the field of linings for funishing purposes, more particularly in the automotive field, consisting of a rigid support of a polyolefinic nature, lined, without the use of adhesives, with one or more flexible, polyolefine-based finishing layers such as fibrous layers, foamed layers, films and the like.

There are already known composite structures for furnishing purposes that are obtained by bonding together, by means of adhesives, a rigid support such as plywood, cardboard, plastics laminates, metal sheets, etc., with e.g. fabrics, carpets or foamed products. However, the preparation of such composite structures, besides requiring a long, complex and expensive technology, involves numerous drawbacks associated with the choice and application of the adhesive in relation to the layers to be assembled.

Moreover, it is not always possible to obtain such structures in a variety of complex shapes, by means of moulding or pressing and, above all, to obtain satisfactory adhesion between the assembled layers.

Still another drawback arises from it not being feasible, in most cases, to re-use (recycle) processing scrap.

It has now been found that it is possible to bond together polyolefine plates with other flexible layers, also based on polyolefins, by a simple, quick, versatile and inexpensive process, generally involving merely pressure and heat and avoiding the use of adhesives, whilst obtaining composite structures affording an excellent adhesion between the layers and in which the mechanical and aesthetic characteristics of the individual layers that served to form the structure are broadly maintained.

One object of the invention is to provide a method of making composite structures or aforesaid in a single operation or operation sequence wherein the bonding of the layers to each other occurs during an extrusion stage of the formation of the polyolefinic plate or during a subsequent thermoforming operation.

Another object of the invention is that of obtaining composite structures that may easily be heat moulded in a wide range of shapes.

Yet another object of this invention is that of enabling processing scrap to be recycled.

The invention consists, in one aspect, in a composite structure comprising a rigid polyolefinic plate 0.5–4 mm thick, bonded directly on one or both faces, i.e. without the interposition of adhesive, with one or more polyolefine-based flexible layers.

As polyolefine plate there may be used plate obtained from polypropylene prevailingly made up of isotactic macromolecules with a melt index of 0.5–7.5, polyethylene, thermoplastic propylene-ethylene copolymers or mixtures thereof, and which may contain conventional additives such as for instance: pigments, lubricants, antistatic agents, flame retardants, fillers and the likes.

The flexible lining layers may suitably be: woven or non-woven fabrics, carpets (pile fabrics), felts (mats), foamed products and films based on isotactic polypropylene, polyethylene, thermoplastic propylene-ethylene copolymers or mixtures thereof.

Particularly suitable as lining layers are the woven and non-woven fabrics based on polypropylene fibres having a specific weight of from 250 g/sq.m. to 800 g/sq.m., foamed polyolefine, in particular cross-linked polyethylene, having a density of 20–100 kg/cm and a thickness of 2–10 mm, and polyolefine films 100–500 microns thick.

A process for the preparation of the composite structures, according to this invention, consists in bonding the polyolefinic plate, whilst at least the respective surface is thermally tackified, with the flexible layer or layers of lining, possibly softened superficially, and suitably then subjecting the complete structure to a pressure not exceeding 10 kg/sq.m.

The bonding process may be carried out following several different methods from amongst which may be mentioned: continuous bonding onto an extruded melt, continuous flame bonding and bonding in the course of thermo-forming, or a combination of such methods.

Continuous bonding onto an extruded melt may be achieved by feeding the supporting plate, as it comes out of the extrusion stage, still in the softened state, through the heated rollers or a calander into which is simultaneously fed the flexible layer to be bonded and which are suitably regulated by adjustment of the gap between the rollers so that there is exerted on the layers a slight squeezing pressure.

The continuous flame bonding may be achieved by passing the layers to be bonded together over a multi-flame blowpipe fed with a combustible gas of known calorific power and developing a sensibly constant temperature, such that superficial fusion of the layers occurs at a temperature regulated by the feeding rate of the layers over the blowpipe. The so-tackified layers are immediately fed between rollers between which there takes place the adhesion.

Bonding in the course of thermo-forming may be achieved during the press-moulding

phase of the flexible finish layer with the rigid supporting plate after preliminary softening *in situ* by means of a suitable removable heating system. In practice, only the supporting plate, arranged between the die and counter-die of a moulding press in which there has already been placed into position the flexible layer, need be heated on one or both of its faces, after the two mould halves are forced against each other with a suitable pressure. By this system the bonding of the layers proceeds concomitantly with the thermoforming of the composite structure.

The composite structures of this invention are particularly suitable for use as rigid lining panels in the furnishing field, especially in the automotive industry where they are used for the lining of the doors, car body body roofs, the interior floor and the luggage compartment.

The following Examples illustrate how the invention may be carried into effect, without being a limitation of the wider scope thereof.

EXAMPLE 1

A composite structure was made up of a polypropylene plate bonded to a needle punched polypropylene fibre mat, the bonding being carried out on the just-extruded plate.

To this end, there was used a single-screw extruder with a degassing device, having an outer diameter of 60 mm and a length of 30 D (D = diameter), fitted with a flat extrusion head 700 mm long.

Into this extruder there was fed in granular isotactic polypropylene of melt index 3, loaded with 40% by weight of talcum powder, maintaining an extrusion temperature of 200°C and a screw revolving speed of 60 rpm.

At the head outlet there was obtained a 2.3 mm thick, 660 mm wide plate which was then conveyed in a still-softened state to a calander.

Into the calander, consisting of three heated rollers of which the first was at 64°C, the second at 128°C and the third at 86°C, there was also continuously fed in between the first and the second pinch rollers, a needle-punched fibre mat of 500 g/sq.m. specific weight made of polypropylene fibres of 17 d.tex. titre.

The rigid composite structure thus obtained had a thickness of 6.3 mm and a specific weight of 3.375 kg/sq.m.

The resulting structure may be used either as such or may be thermoformed into a finished product intended to meet, from the aesthetic as well as functional point of view the specific requirements of the automotive field, that is, for the lining of the inner floor, of the doors, the rear shelf and the like.

EXAMPLE 2

In this case a polypropylene plate was bonded to a needle punched polypropylene fibre mat, the bonding being effected in the course of thermoforming.

To this end, there was used a thermoforming machine consisting of a mould, a counter-mould, two frames and a system of removable infra-red heating panels.

On one of the two frames, arranged between the mould and counter-mould, there was placed a needled polypropylene fibre mat of 500 g/sq.m., whose fibres had a 17 d.tex. titre, and on the other frame there was placed a polypropylene plate of the same characteristics as those of the plate obtained by extrusion as described in Example 1.

Thereupon, both faces of the plate were heated by means of the infra-red heating panels, bringing them up to a temperature of 190°C. Then, after removal of the panels, the two mould halves were brought together, thus obtaining with one operation both the bonding of the plate to the needle-punched fibre mat and the moulding of the composite structure.

The rigid composite structure thus obtained had a thickness of 6.3 mm and a specific weight of 3.375 kg/sq.m.

EXAMPLE 3

There was prepared a composite structure consisting of a rigid polypropylene plate, an intermediate cross-linked polyethylene foam layer and a needle-punched polypropylene fibre mat.

The procedure of Example 1 was repeated except that, instead of the needle-punched polypropylene fibre mat, there was introduced between the first and second pinch rollers of the calander a layer of cross-linked expanded polyethylene of 4 mm thickness and specific density of 30 kg/cm, to provide a bonded structure of the plate and foamed layer.

The composite structure thus obtained at the outlet of the calander was then heated on the exposed surface of the foamed layer, so achieving superficial melting and tackifying of the foamed layer itself, which was then bounded to a needle-punched polypropylene fibre mat weighing 500 g/sq.m. and whose fibres showed a titre of 17 d.tex. by means of pinch rollers.

The three-layered composite structure thus obtained, i.e. plate/foamed layer/needle-punched fibre mat, had a thickness of 9.8 mm and a specific weight of 3.495 kg/sq.m.

This three-layered structure, because of its lightness, sound-deadening propensities and its aestetic characteristics imparted by the textile surface, was found to be particularly suitable for use as linings in the automotive industry.

CLAIMS

1. A composite structure comprising a rigid polyolefine plate 0.5–4 mm thick

bonded directly on one or both faces to a relatively flexible layer of polyolefine material.

2. A structure according to Claim 1 in which the polyolefine of the plate comprises prevailingly isotactic polypropylene, polyethylene, thermoplastic propylene-ethylene copolymers or mixtures thereof.

3. A structure according to Claim 2 in which the plate is of polypropylene with a melt index of 0.5–7.5.

4. A structure according to Claim 1, 2 or 3 in which the relatively flexible layer or one of them is woven or non-woven isotactic polypropylene fibre fabric of specific weight 250–800 g/sq. mt.

5. A structure according to Claim 1, 2 or 3 in which the relatively flexible layer or one of them comprises foamed polyolefine of density 20–100 kg/cm and is 2–100 mm thick.

6. A structure according to Claim 1, 2 or 3 in which the relatively flexible layer or one of them is a polyolefine film 100–500 microns thick.

7. Composite structures according to Claim 1, substantially as hereinbefore exemplified.

8. A process for preparing a composite structure as set forth in Claim 1, in which the plate and relatively flexible layer are bonded together whilst at least the surface region of the plate is tacky as a result of the application of heat.

9. A process according to Claim 8 in which the bonding is effected under a pressure not exceeding 10 kg/sq.cm.

10. A process according to Claim 9 or 10 in which a pre-formed plate is made superficially tacky by the application of heat and then bonded to said relatively flexible layer.

11. A process according to Claim 9 or 10 in which the bonding is effected whilst the just-formed plate is still hot.

12. A process according to Claim 9 or 10 in which the bonding is effected concurrently with thermoforming.

13. Automobile body lining panels comprising composite structures according to any of Claims 1–7.

14. Automobile body lining panels according to Claim 5, in which the relatively flexible layer of foamed polyolefine is overlaid by and directly bonded to a polyolefine textile layer.

15. Panels according to Claim 14 in which the textile layer is a needle-punched fibre mat.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.